

# R&D on offshore wind power plants

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# ECN Wind Energy R&D on offshore wind power plants

Dr. Peter Eecen

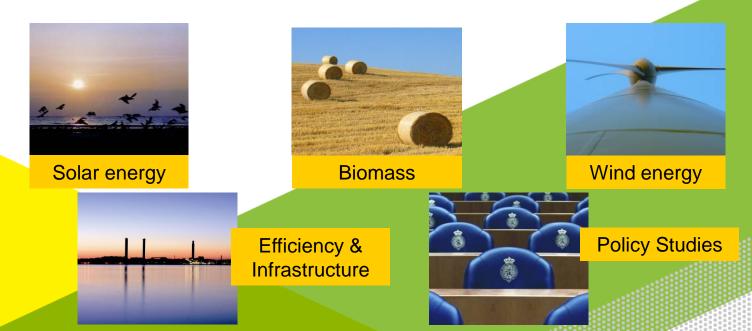
**NORCOWE** 

21-5-2013

#### Energy Research Centre of the Netherlands



- ECN is the largest, independent, market oriented and innovative Dutch energy research institute.
- ECN investigates and develops technologies and products for a safe,
   efficient and environment-friendly energy supply with 600 fte.
- With and for the market the energy technology is developed by ECN.





## ECN Wind R&D Strategy

### Offshore Wind Power Plants

**Reduce COE of Offshore Wind Power Plants** 

Planning & Design

Construction

**Operations** 

80% of EU offshore wind farms have been realised with ECN support

By 2015
ECN will have facilities for 14MW+ prototype turbines

Top industrial players are exploiting ECN technology and knowledge

# A Wind of Change Working with the industry







- 2. Component analysis
- 3. Software based analysis
- 4. Onshore development
- 5. Wind turbine + wind farm



- 1. Wind farm performance improvement
- 2. Component analysis for wind farms
- 3. Simulated & Measured improvement
- 4. Offshore development
- 5. Integrated wind farm approach

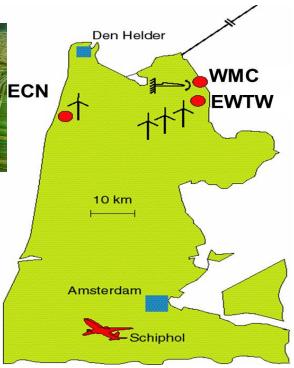




# ECN: Developing wind since 1974









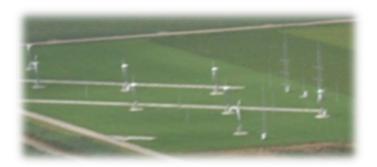








- Five 2.5MW research turbines N80 with one 108m high meteorological mast
- Five locations for prototype turbines with meteorological masts (108m, 108m, 100m and 100m)
- Measurement Infrastructure
- Measurement Pavilion



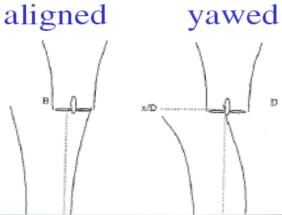
Scale Wind farm



#### Wind Farm Control

- Yaw upstream turbine :
  - Less power (higher loads)
  - Yaw deflects wake

Downstream turbines yield higher product





Test ongoing in ECN scale wind farm



#### Offshore facilities

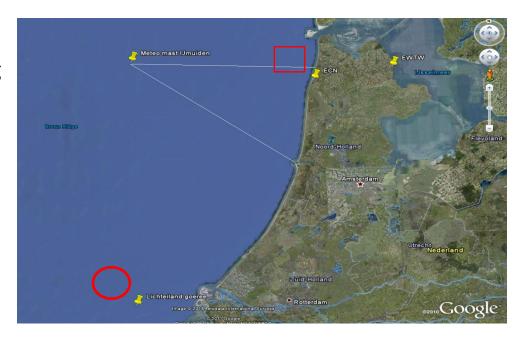


- Measurement and evaluation programme Egmond aan Zee
- Various demonstrations of innovations in offshore wind farms
- Measurement Mast IJmuiden
- Goal: demonstration of innovations with industry in offshore wind farm 'Leeghwater' previously known as 'Proeftuin op Zee'



### Lidar systems at operation

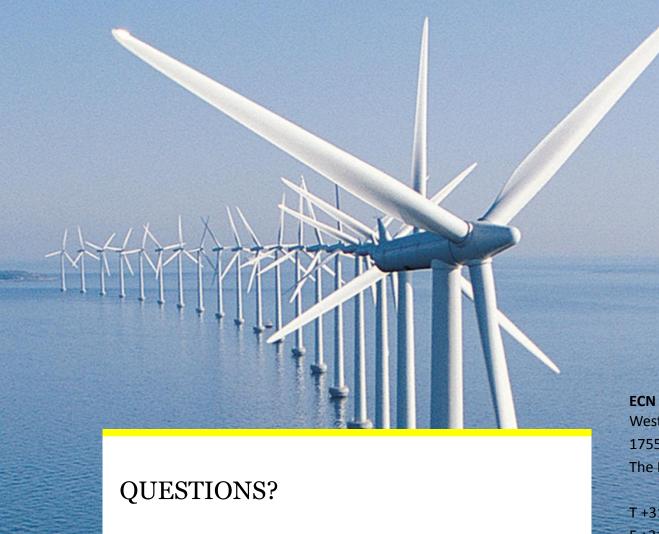
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  - Offshore
  - 75 km from IJmuiden
  - At the height of Callantsoog
- EWTW
  - On shore
  - Flat, agricultural terrain
  - About 35km from ECN
- 'Lichteiland' Goeree
  - Offshore
  - KNMI measurement station
  - About 30km from shore



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- Offshore wind will be a economically large sector.
- ECN together with the Dutch industry has gain a top-position in realising the offshore wind farms.
- Strategic R&D-focus ECN:
   Offshore wind power plants



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# Strategic Alliances ECN Wind – R&D partners





TU Delft: strategic partner with Collaborative R&D programme.





WMC: strategic partner with Collaborative R&D programme.



 EERA JPWind: Coordinator programme Aerodynamics and member of the board.
 (a.o. DTU, Fraunhofer, CENER, CRES, Sintef, Forwind, TUDelft, WMC)



MARIN: Collaborative R&D through JIPs



NREL: CRADA. Collaborative R&D activities

**ECN** 

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